THE CHANGING DISTRIBUTION OF *VOLUCELLA INANIS* (L.) (DIPTERA: SYRPHIDAE)

ROGER K. A. MORRIS[1]
& STUART G. BALL[2]

[1]*c/o 241 Commonside East, Mitcham, Surrey CR4 1HB*
[2]*255 Eastfield Road, Peterborough, Cambridgeshire PE1 4BH*

Abstract. The historic distribution of the hoverfly *Volucella inanis* is investigated, following reports that it is undergoing a significant expansion in range. We demonstrate that *V. inanis* underwent a contraction in range prior to 1960. From then until the 1990s, records were concentrated in south-east England after which evidence of range expansion becomes readily apparent, although there are no indications that it is moving back into its former western range. The reasons for these changes are unclear, but climatic factors are believed to be the implicated factor.

INTRODUCTION

Verrall (1901) regarded *Volucella inanis* (L.) as a 'rather rare species' but reported that it was known 'in considerable numbers from Devonshire, Somersetshire, Hampshire, Sussex and Essex'. By the end of the 20th Century, with noteworthy exceptions, it was largely confined to south-east England from the Solent to Suffolk (Ball & Morris, 2000), closely mirroring its near relative *V. zonaria* (Poda). The data we hold show that its western distribution included an extensive scatter of records from the Solent to Cornwall prior to 1960 and there are single records from north Devon, south Wales and a few from Dorset and the Isle of Wight recorded between 1980 and 1989. By 1999, its inland distribution extended well beyond the London area, throughout Surrey (Morris, 1998) and into Hampshire, Berkshire, and Hertfordshire, with an outlying record from Chippenham Fen, Cambridgeshire, but it seems to have disappeared entirely from western England.

Since 1999 there have been a number of remarkable new records from such diverse locations as Peterborough and elsewhere in Cambridgeshire (Stubbs, 2001), Leicestershire, Norfolk, Nottinghamshire and Staffordshire. The number of new records from such outlying locations is a clear indication that *V. inanis* is undergoing an expansion of range that is much wider in extent than *V. zonaria* (Morris & Ball, in press). In tandem with our investigation into the changing distribution of *V. zonaria* we have undertaken a similar exercise to consider the story of *V. inanis*.

Unlike *V. zonaria* (over 1000 records) we have many fewer records of *V. inanis*, (over 750), covering a much greater timespan. One possible reason is that *V. inanis* was considered to be an established component of the British fauna and did not elicit great interest and regular publication of records. Our knowledge of this species' historic distribution is therefore confined to museum specimens and occasional literature records. The establishment of the Hoverfly Recording Scheme in 1976 meant that there was a co-ordinated effort to assemble records and this means that caution must be attached to perceived distributions prior to 1970, and the changes that appear to have occurred, but some broad observations can be made. It is clear from figure 1 that the numbers of records jumped around the time that the Hoverfly Recording Scheme was launched, and even more so after *British Hoverflies* (Stubbs & Falk, 1983) was published but, even so, yearly numbers fluctuate dramatically.

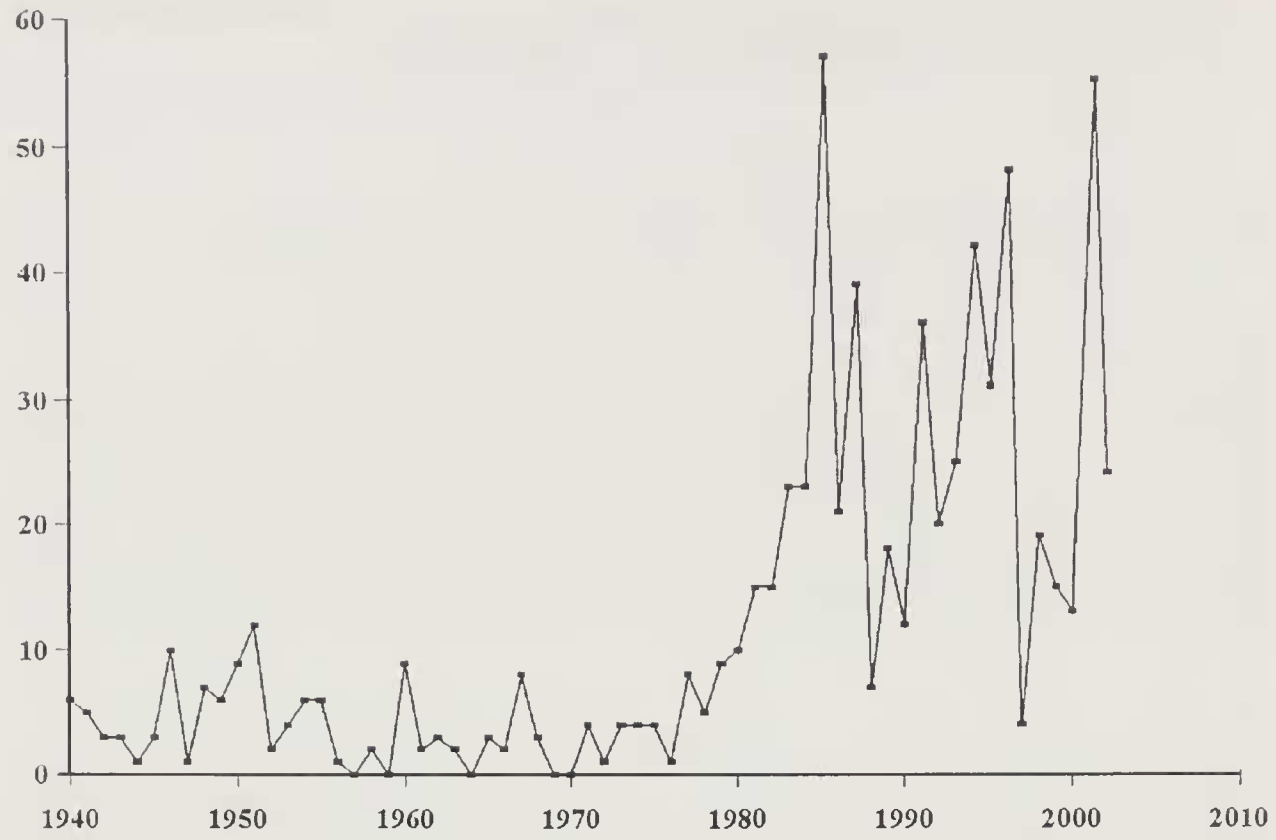

Fig. 1. Numbers of records of *Volucella inanis* 1940–2001.

Historical changes

There would appear to have been two distinct changes in distribution. Firstly a contraction of the western range to eastern England during the middle of the 20th Century, followed by a northward expansion of range from the 1990s onwards.

Over the 65 years from 1874 (the first record we have) to 1939, the majority of records are of occasional single individuals, although some localities seem to have yielded records on a number of occasions. For example, there are regular records from the New Forest at the turn of the 19th Century, with a number of F. C. Adams specimens in the collections of the Natural History Museum (London). It is therefore possible that *V. inanis* was only a partial resident, with numbers augmented by vagrants or migrants. The mainly coastal nature of the records (Figs. 2a & 2b) might support this conjecture, although it is curious that further southwesterly records are largely absent after the 1960s (Figs. 2c, 3a–c). Between 1940 and 1959, the majority of records were concentrated in the London area and in parts of Dorset and Hampshire to some extent mirroring the distribution of *V. zonaria*. However, in the early 1940s, *V. inanis* was certainly well established on the north Devon coast: there are six specimens (3♂♂, 3♀♀) from Lynton, Devon, between 10 and 17 August, 1941.

The recorded distribution between 1960 and 1979 (Fig. 2c) shows that the principal concentration of records was in south-east England, with a scatter of records from Dorset. Anecdotally, it seems that there may have been a significant contraction of range in the 1960s, with records concentrated in London and the Home Counties, Sussex and Kent. The late Cyril Hammond's diary, for example, lists no records between 1961 and 1966 but resumes with regular records from 1967 until 1979. Furthermore, despite regular forays into the Surrey countryside, he fails

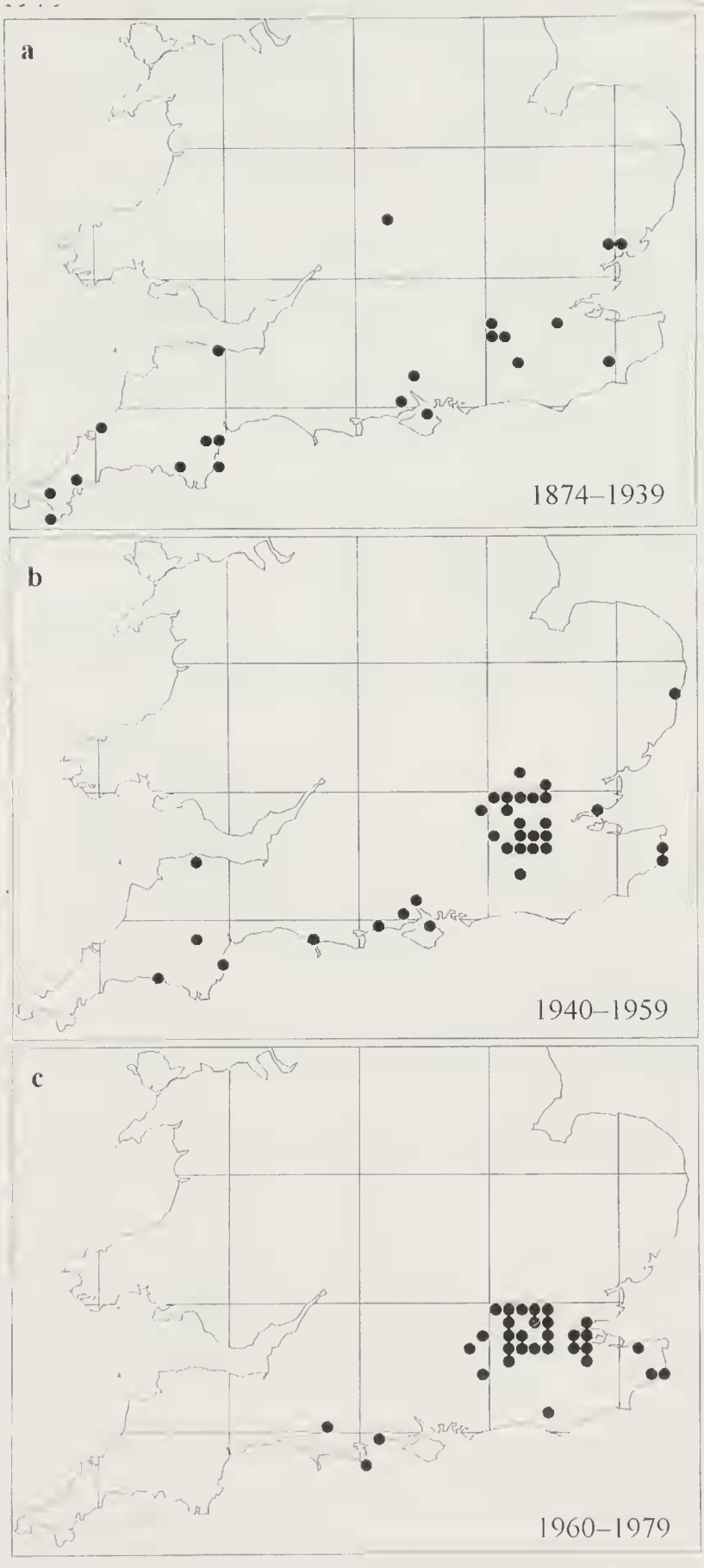

Fig. 2. Distribution of *Volucella inanis* in Southern England 1874 to 1979.

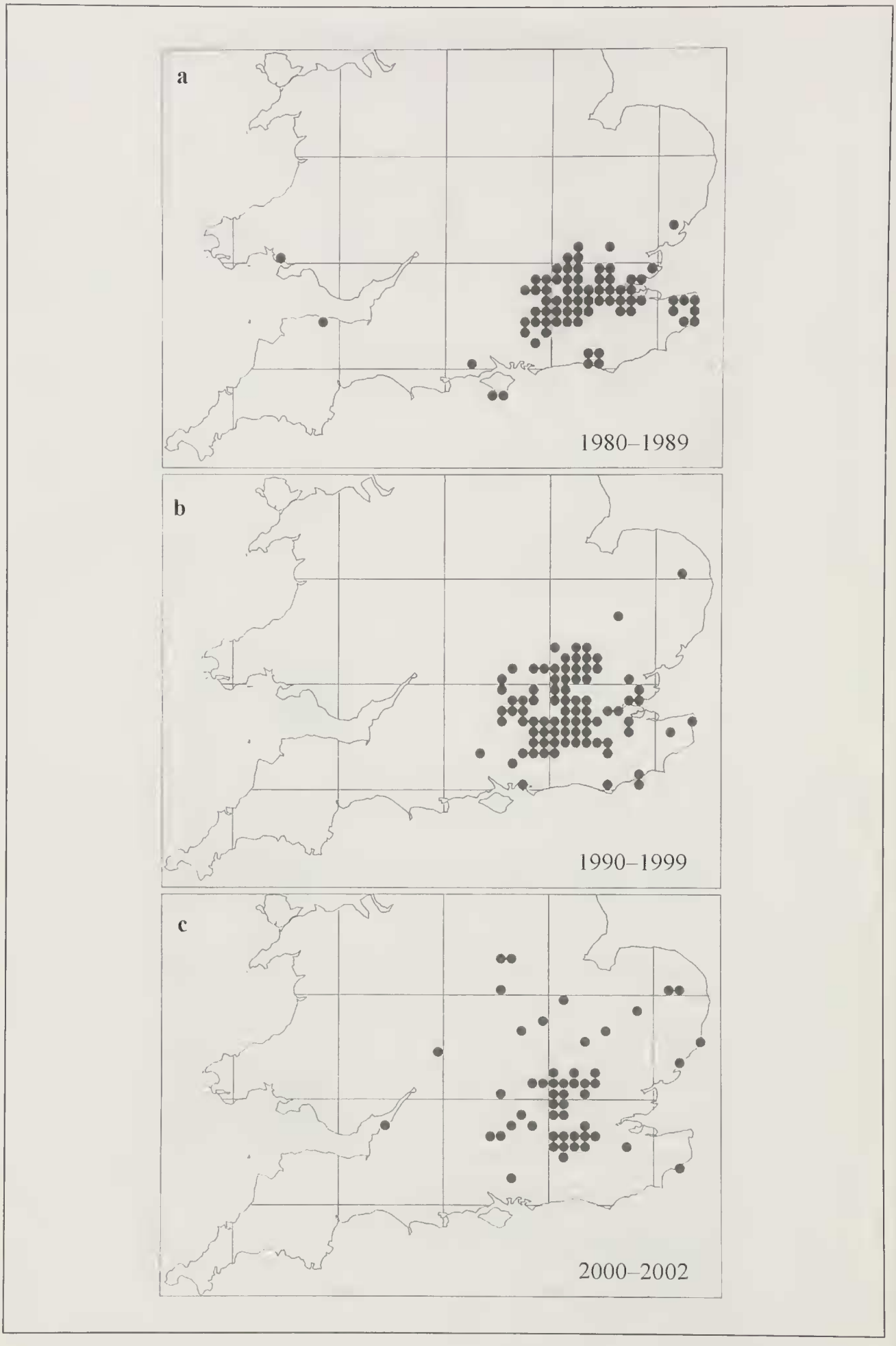

Fig. 3. Distribution of *Volucella inanis* in Southern England and Wales 1980 to 2002.

to record *V. inanis* amongst the hoverflies listed. The reason for this drop in reports in the 1960s is unclear, but it is possible that the period of extreme cold weather was a significant factor.

Concentrated recording effort in the 1980s, especially in Surrey, showed that *V. inanis* was well established in London and the Home Counties, Kent (Clemons, 1998), Sussex and parts of Hampshire; with outlying records from Devon and south Wales (Fig. 3a). Its northern range appears to be more extensive than that for the 1970s and there are the first indications of an expansion in range. This of course may be an artefact of improved recording, but it is possibly more than coincidence that a similar picture is presented in the better recorded *V. zonaria*. Evidence of expanding range is more marked in the 1990s, which show substantial expansion northwards into Hertfordshire, and westwards into Berkshire and Oxfordshire, and north-east into Cambridgeshire and Norfolk (Fig. 3b). However, despite extensive and detailed recording in western England, especially Dorset and Somerset, there are no records of *V. inanis*, suggesting that it had disappeared across its western range.

In 2001 there were unprecedented reports from eastern England of *V. inanis* at localities far away from its known range. Stubbs (2001) reports records from south Cambridgeshire where there were numbers of records, Leicestershire and Nottinghamshire (Fig. 3c). There is also a record from Northamptonshire sent independently to the Hoverfly Recording Scheme, a report from Thetford of a specimen at an mv trap, and records from Norwich (Paston, 2001) which indicate that a population had become established in west Norwich in the late 1990s. However, records supplied to the Hoverfly Recording Scheme are not complete and the full picture for the period since we last trawled records is not available.

What is causing these changes in range?

At the moment, it is far from clear why there has been a contraction in western range. However, the expanding distribution in to the midlands and eastern England can potentially be explained.

We know that the 1990s saw a period of unprecedented warm weather, with average yearly temperatures exceeding past records in most years (Bealey *et al.*, 1998). Many components of the natural environment have responded accordingly, including expansions in the range such as that of *V. zonaria* (Morris & Ball, in press), and earlier emergence times for some species, for example *Epistrophe eligans* (Harris) which has recently been emerging in March in south London (Morris, 2000). Observed changes in the range of *V. inanis* are therefore likely to be a response to climate change.

As we have shown for *V. zonaria*, it is possible to relate the distribution of some species to climate maps. In the case of *V. zonaria*, a clear link to winter and summer mean temperatures has been demonstrated. The distribution of *V. inanis* differs from *V. zonaria* in a number of ways, not least because it appears to be largely confined to eastern England and at the moment is seemingly absent from the majority of the south-west. It is expanding northwards, but there is little evidence of significant westward expansion. This tends to suggest that average summer temperatures are likely to be more influential than minimum winter temperatures. Unfortunately, this is rather less clearly defined than we have been able to show for *V. zonaria*. Exceptionally hot summers, such as those in the early 1990s do not seem to be the over-riding factor, as an expansion in range might have been expected much earlier than the data suggest. However, average summer temperatures do seem to be a possibility. It remains to be seen how much further the range of *V. inanis* will expand.

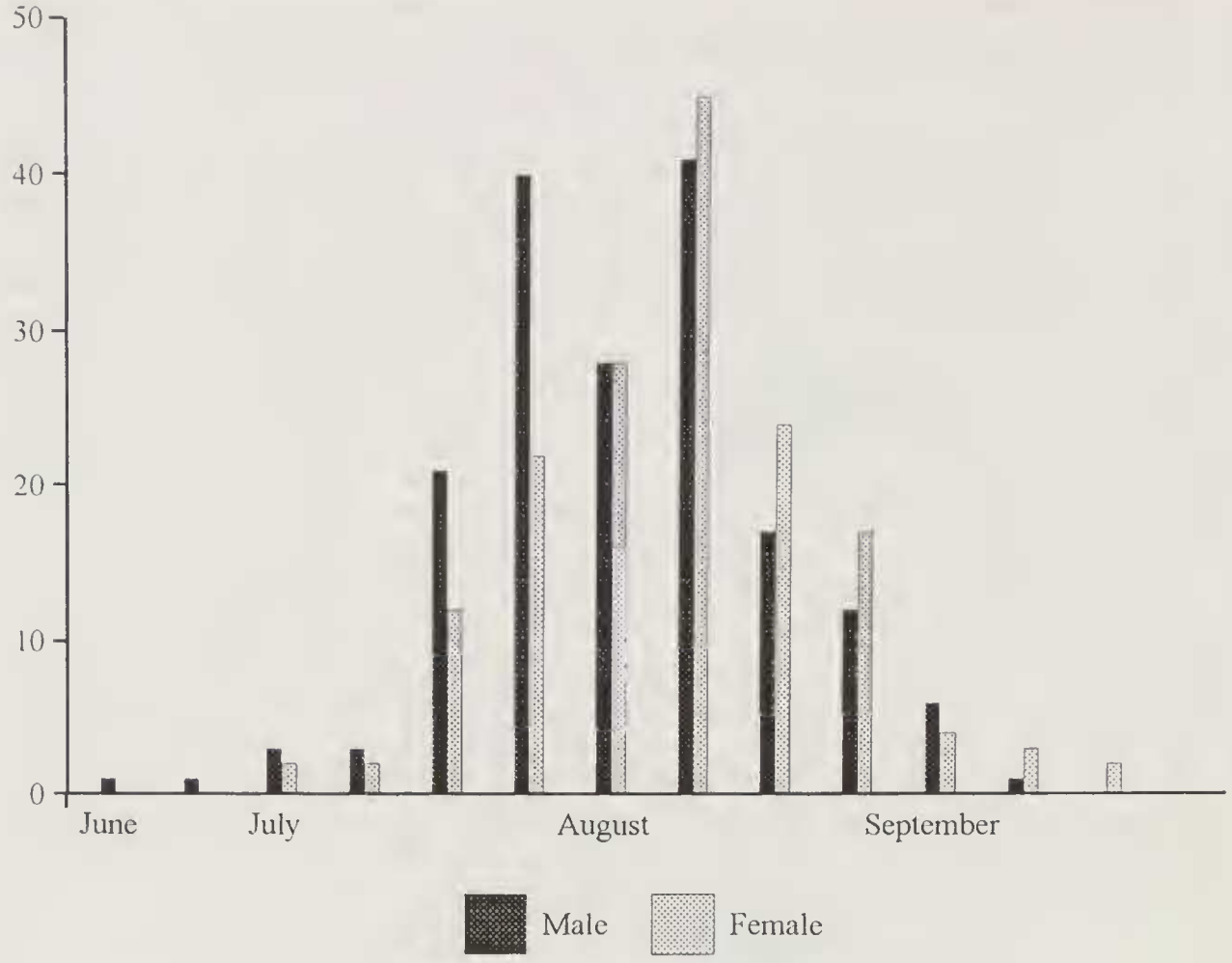

Fig. 4. Phenology of male and female *Volucella inanis*

Additional notes on biology

Stubbs & Falk (1983) report associations with *Vespula germanica* (Fabr.) and the hornet *Vespa crabro* L. One of us (R.K.A.M.) has seen this species investigating a wasp's nest in a roof and there is a specimen in the Natural History Museum (London), taken by W. J. Tampion in 1952, bearing a data label indicating that the specimen had been taken at a hornet's nest. There is also a report from Mark Telfer of three larvae found on a window sill in October/November 2001, together with large numbers of dead wasps (unknown species) which had fallen through a hole in the ceiling of a house in Stoke Mandeville (Bucks). These larvae were kept in damp sand indoors and yielded three *V. inanis* between 6 and 9 February 2002.

Unlike other *Volucella* which are mainly predators and/or scavengers in vespine nests, *V. inanis* larvae are ectoparasites of wasp grubs (Rotheray, 1993). The reported link with hornets may be influential in determining the ongoing expansion in range of *V. inanis*, because hornets themselves are reported to have had a number of successful years. This may help to explain the presence of *V. inanis* in Peterborough where hornets are well established. However, there are parts of the range of *V. inanis* where hornets do not appear to occur (see distribution map in Edwards, 1997).

The phenology of *V. inanis* shown in Ball and Morris (2000) indicates that this species occurs from June to September, but more detailed analysis of the occurrence of males and females shows that the earliest records are for males and the latest for females. However, unlike *V. zonaria* both sexes are more coincident (see Fig. 4).

Males peak towards the end of July and through to the second week of August, whilst females peak in the second week of August.

Comments

Unlike the story for *V. zonaria*, that of *V. inanis* is less clear-cut and there are a number of conundrums. Why, for example, has its distribution switched away from south-west England? Also, is the current expansion of range linked in any way to the changing fortunes of the hornet? And, of course, can the climatic factors we have identified be refined further?

There are real opportunities to answer some of these questions given detailed recording. We are keen to receive all records of this species and other hoverflies, especially regular counts from frequently visited sites or from gardens. In keeping with our call for careful recording of *V. zonaria* in relation to episodes of high migrant activity, it would also be helpful to see whether any similar picture emerges for *V. inanis*. Much more can be gleaned from studying the remains of wasp and hornet nests, developing a picture of the preferred vespine associations in Britain.

Acknowledgements

The authors are indebted to the many individuals who have contributed to the Hoverfly Recording Scheme that forms the basis for this account. We also thank Dr Ian White of the Natural History Museum, London, for access to the collections.

References

Ball, S. G. & Morris, R. K. A. 2000. *Provisional atlas of British hoverflies*. Centre for Ecology and Hydrology, Abbott's Ripton.

Bealey, C., Howells, O. & Parr, T. 1998. Environmental change and its effects on wildlife: the role of the environmental change network. *British Wildlife* **9**: 341–347.

Clemons, L. 1998. Further notes on the genus *Volucella* (Diptera: Syrphidae) in Kent. *Bulletin of the Kent Field Club* **43**: 77–84.

Edwards, R., ed. 1997. *Provisional atlas of the aculeate Hymenoptera of Britain and Ireland*. Bees, Wasps & Ants Recording Society. Huntingdon. Biological Records Centre.

Morris, R. K. A. 1998. *Hoverflies of Surrey*. Surrey Wildlife Trust, Pirbright. 244pp.

Morris, R. K. A. 2000. Shifts in the phenology of hoverflies in Surrey: do these reflect the effects of global warming? *Dipterists Digest* (second series) **7**: 103–108.

Morris, R. K. A. & Ball, S. G. (in press). Sixty Years of *Volucella zonaria* (Poda) (Diptera: Syrphidae) in Britain. *British Journal of Entomology & Natural History*.

Paston, S. 2001. Observations of the hoverfly *Volucella inanis* in west Norwich. The Norfolk Natterjack, Bulletin of the Norfolk & Norwich Naturalists' Society, **75**: 2.

Stubbs, A. E. 2001. Wildlife reports: Flies. *British Wildlife* **13**: 131–133.

Stubbs, A. E. & Falk S. J. 1983. *British Hoverflies: an illustrated identification guide*. British Entomological & Natural History Society, London.

Rotheray, G. E. 1993. Colour Guide to Hoverfly Larvae (Diptera, Syrphidae). *Dipterists Digest* (first series) **9**. 156pp.

Verrall, G. H. 1901. *British Flies* 8: *Platypezidae, Pipunculidae and Syrphidae*. 691pp., London.